

Blending Light With Heavy Crude Oil To Increase Pipeline Capacity

The Challenge: Cost-Effectively Move Heavy Crude Oil to Market

The Koch and Marathon/Ashland refineries in the Twin Cities area of Minnesota needed to increase their feedstock supplies to meet increased market demand for a variety of products including gasoline, fuel oil for home heating, jet fuel, asphalt, and even carbon dioxide. These products are all made from crude oil delivered to the refinery by Koch Industries subsidiary, Minnesota Pipe Line Company. Minnesota Pipe Line carries oil from Canada and western North Dakota to refineries for further processing along an overall 679-mile (1093 km) route. (See Figure 1).

The feedstock passes through nine pumping stations in Minnesota on the 250-mile (402 km) route between Clearbrook and Rosemount. All are powered by large electric motors that provide the needed force to move the oil through the line. Some pumping stations, such as the one at Clearbrook, serve as hubs where oil is stored in holding tanks until needed, blended with other grades of oil, and/or directed to the locations where it is most needed. More than 60 percent of the crude oil carried by the line is characterized as highly viscous. The thick, heavy characteristics of this oil makes movement through the pipeline more difficult and causes pump motors to work harder, increasing the energy requirements and costs for delivery of the oil to the plant. During the winter, cold temperatures cause the drag of the crude oil to be even more pronounced, slowing delivery rates and increasing the amount of energy consumed to move each barrel of oil through the line.

Koch Pipe Line Company, Otter Tail Power Company, and Northern States Power Company (NSP) worked together to implement a low capital cost approach,

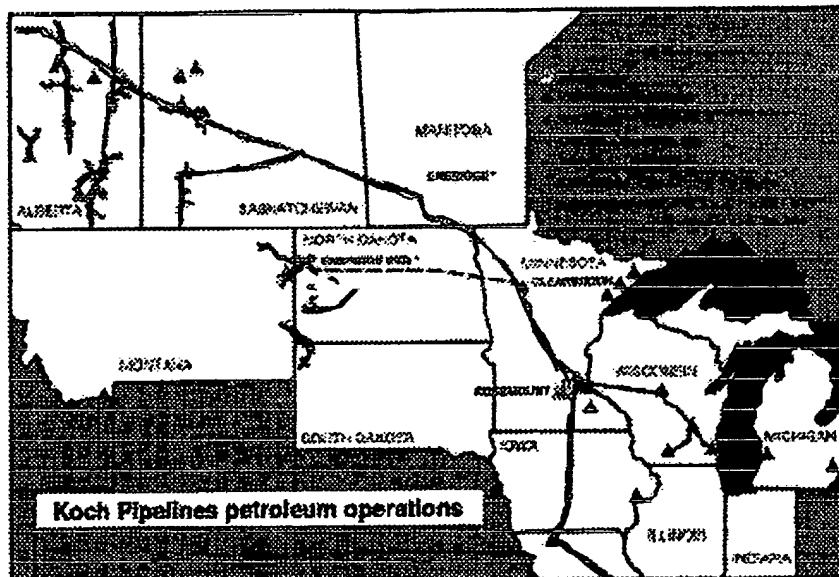


Figure 1. Minnesota Pipe Line, a subsidiary of Koch Industries, increased the flow of crude oil from its Clearbrook pumping station to the Rosemount refinery and saved energy by blending high viscosity crude with low viscosity crude.

which actually saved energy, while increasing pipeline capacity.

The Old Way

The conventional approaches to this type of problem are to either add a parallel pipeline or add midpoint pumping stations to increase the throughput in existing lines. Both approaches would have more than provided the added capacity that Koch sought. However, initial construction costs were comparatively high, and both methods would have increased ongoing power consumption and demands.

The New Way

In 1997 Minnesota Pipe Line implemented an operation at the Clearbrook site to blend high-viscosity crude with lower-viscosity crude to create a new grade of crude with better flow characteristics. Special metering equipment was used to automate the oil-blending process. Variable speed drives, which improve the efficiency

of motor-driven processing and pumping systems, were installed to control several 1000-horsepower motors at the Clearbrook site. Additional work was done at the Hugo, MN facility just upstream of the Rosemount Refinery. The willingness of Minnesota Pipe Line's refinery customers to accept consistently blended oil deliveries allowed the project to proceed.

The Results: Low Capital Cost and Reduced Operating Cost

This project gave a dramatic increase in pipeline capacity for a relatively low cost. And, it carried the added benefit of reducing power consumption and demand for the overall system at the previous flow rates. In addition the project reduced energy demands at the eight other pumping stations along the pipeline's route between Clearbrook and Rosemount.